Good Morning, UFOMA

Outline:

- Electricity, present & future
- Energy Savings
- LED cost benefit /ROI
- Product Testing
- Pilot program

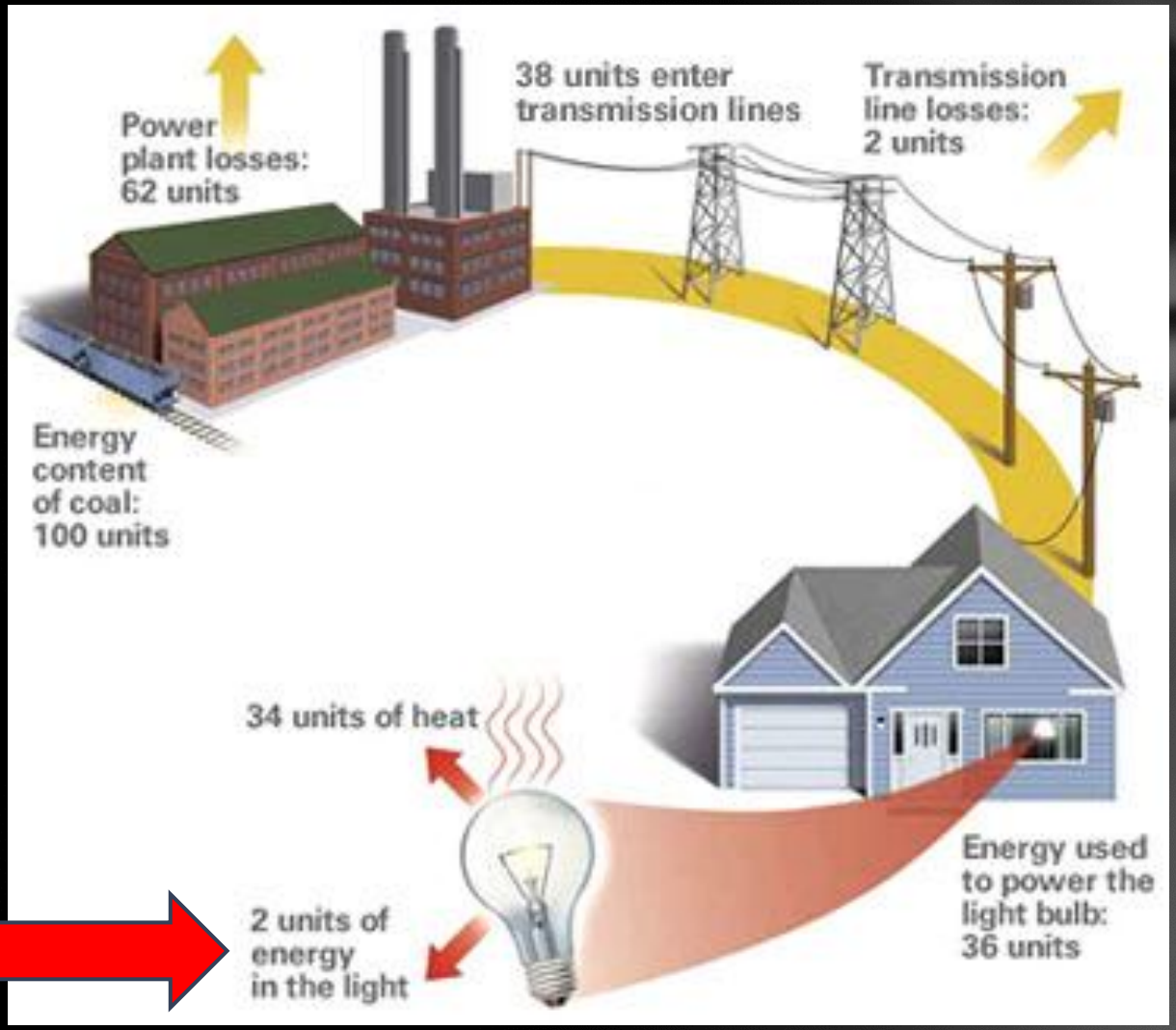
Quantum Lighting Group

LED's:

Arguably the most disruptive technological advancement to ever hit the lighting industry.

Also the technological advancement with the most promise for today and the future.

Where does our power come from? Why is saving energy important?



Power costs on the rise!

Standard Examiner 4/4/2011

OGDEN – "Rocky Mountain Power is warning its customers that electricity bills in Utah are going to rise somewhere between 80 and 100 percent over the next decade."

"Our world has become more complex, and we're asking for a price increase every year,"

"Beginning around 1990, Utah's price for electricity steadily dropped relative to the rest of the country. It is now about 33 percent lower than the national average. RMP's price has failed to keep up with inflation by about the same rate, and that's a situation that can't continue."

Rocky Mountain Power President A. Richard Walje

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What can you do?

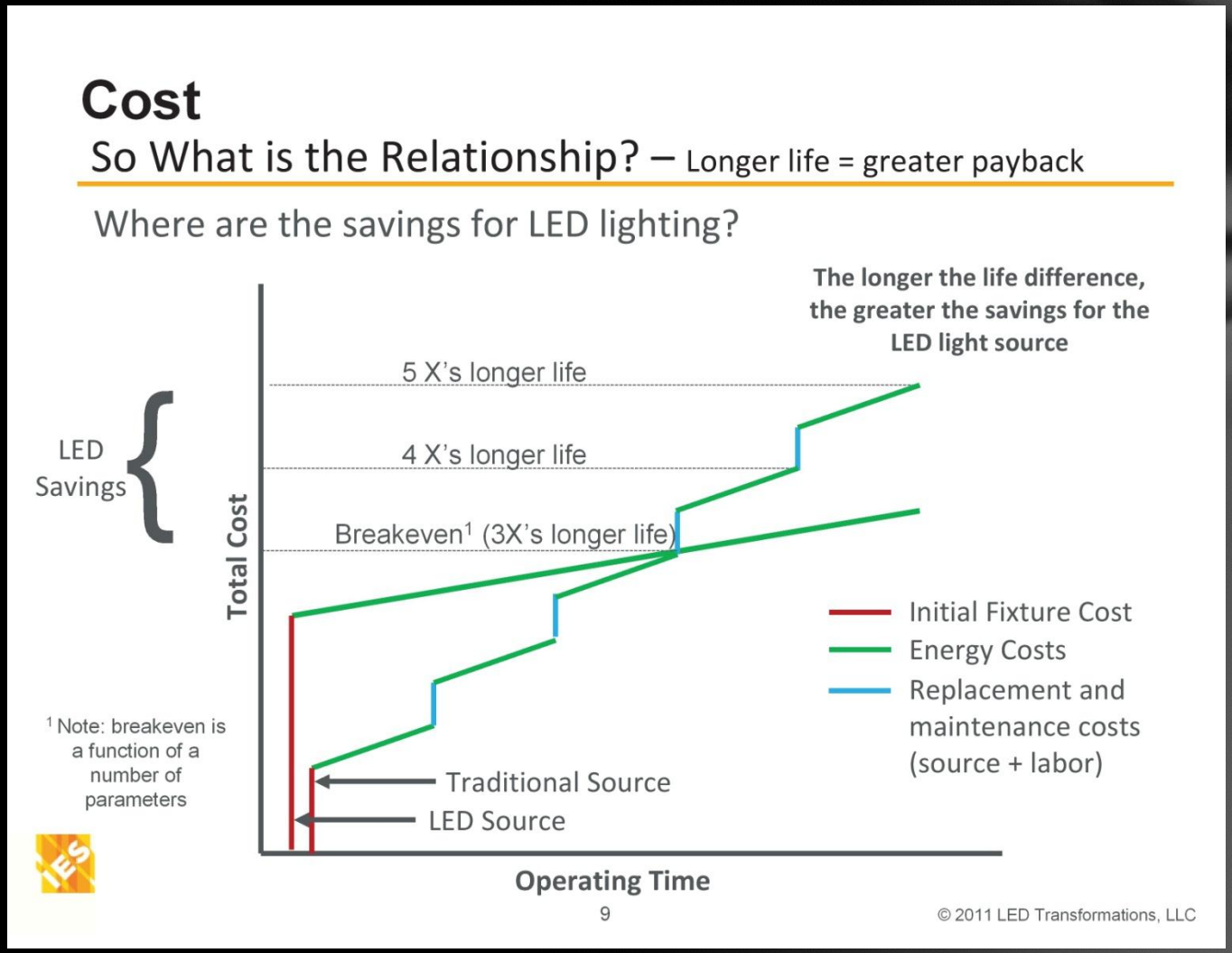
Salt Lake Tribune, Apr 12, 2011

Jeff Hymas, senior communications consultant at Rocky Mountain Power, says many business mangers want their companies to go green, but they don't know how to implement energy-efficient practices.

What's the single most energy-efficient move businesses can make?

Upgrading electric equipment to more efficient models. Replacing older lighting systems with new technology is a simple step that can make a big difference.

But…… Energy Savings is the small story, MAINTENANCE IS WHERE THE REAL SAVING ARE!



DOE research

Economics
Where do LEDs make sense?

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Maintenance

- Lamps & Ballasts have to be monitored and replaced
- Maintenance is a real cost, not always factored in or known
- Actual price will vary by mounting height and geographical location
- Real numbers from real installations:
  - $225 – average
  - $65 / person / hour – RS Means
  - $130 - $150 – Minnesota
  - $225 – California
  - $400 – New Hampshire
- Deferred maintenance costs helps with payback of LEDs

Source: PNNL

18 | Commercial Building Energy Alliance PNNL-SA-77933

But…… Energy Savings is the small story, MAINTENANCE IS WHERE THE REAL SAVING ARE!

QUANTUM Lighting Group, Inc.

HID Lamp Life:

Traditional lamp source's life is determined when 50 out of 100 lamps have failed.

LED Lamp Life:

LED's are considered at their end-of-life at 70% of their original light output.

Don't forget the ballast and photocell, they fail too!

HID lamps should not be operated at higher-than-rated wattages. This can be caused by using a capacitor with a rating too high for the fixture, or by installing a lamp with a lower wattage rating than the fixture. Although light output may increase, the excess wattage dramatically increases operating temperatures of electrodes, arc tubes and bulb walls. The arc tube may bulge and possibly shatter. Lumen maintenance and lamp life also are significantly decreased.

HID lamps also are sensitive to voltage interruptions. If the lamp circuit is turned OFF, a momentary power outage occurs, or the lamp voltage drops below the level needed to sustain the arc discharge, the ions in the arc tube deionize and light output stops. The lamp will not restart immediately. This is because the arc gases are now under pressure and the lamp must cool sufficiently to reduce the vapor pressure to a level where the arc will restrike at the available voltage. The time required to relight is strongly influenced by the design of the luminaire, since this will determine to a large extent the cooling rate of the lamp. In general, mercury vapor lamps will relight in 8 to 10 minutes, metal halide lamps in 10 to 45 minutes, and HPS lamps in 1 minute or less.

HID LAMP LUMEN MAINTENANCE

Light output from all types of HID lamps gradually declines over time. Lumen maintenance depends on a number of light loss factors. These include any physical changes in the lamp, such as electrode deterioration, blackening of the arc tube or bulb, shifts in the chemical balance of the arc metals, or changes in ballast performance. Longer burning cycles result in better lumen maintenance because there is less stress on lamp components due to frequent starting. Other factors affecting lumen depreciation are lamp watts and current, and the current waveform that is a function of the lamp and luminaire circuit. Ambient temperature does not have a great effect on the maintained light output of HID lamps.

TABLE 1: HPS LAMP DATA

ANSI Code	Lamp Watts	Rated Lamp Life[1]	Rated Voltage	Minimum Socket Voltage[3]	NEW Lamp Voltage Range (at 100 Hours)[2]	Nominal Lamp Amps	End-of-Life Lamp Voltage	Average Volts Increase Per 1,000 Hours Life
S76	35	16,000+ Hrs.	52	110	46-62	0.83	84	1.5
S68	50	24,000+ Hrs.	52	110	46-60	1.18	84	1.5
S62	70	24,000+ Hrs.	52	110	45-60	1.60	84	1.5
S54	100	24,000+ Hrs.	55	110	44-62	2.10	84	1.5
S55	150 (55 volts)	24,000+ Hrs.	55	110	48-62	3.20	88	1.5
S56	150 (100 volts)	24,000+ Hrs.	100	198	85-115	1.80	160	1.5
S66	200	24,000+ Hrs.	100	198	90-115	2.40	160	1.5
S50	250	24,000+ Hrs.	100	198	90-120	3.00	160	1.5
S57	310	24,000+ Hrs.	100	198	90-120	3.60	160	1.5
S51	400	24,000+ Hrs.	100	198	84-115	4.60	140	1.5
S52	1000	24,000+ Hrs.	250	456	210-275	4.70	350	1.5

[1] Rated lamp life is based on 50% survival.
[2] 100 hours is lamp manufacturer specification for stabilizing light output.
[3] Also called open circuit.

CAUTION: Disconnect starting lead not common to the lamp to eliminate the starting voltage when checking the minimum open circuit voltage. The starting voltage may damage your voltmeter.

AEL American Electric Lighting An AcuityBrands Company

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Let's do the math…

Typical LED lamp life outdoor is ~100,000 hours

H.I.D. lamp (25K) changes = 3
H.I.D. ballast life (30K) changes = 2
Photocell (?) changes = 1

(6) Trips up the pole @ $225 each = $1,350
(in todays dollars)

Energy savings is just the "icing on the cake".

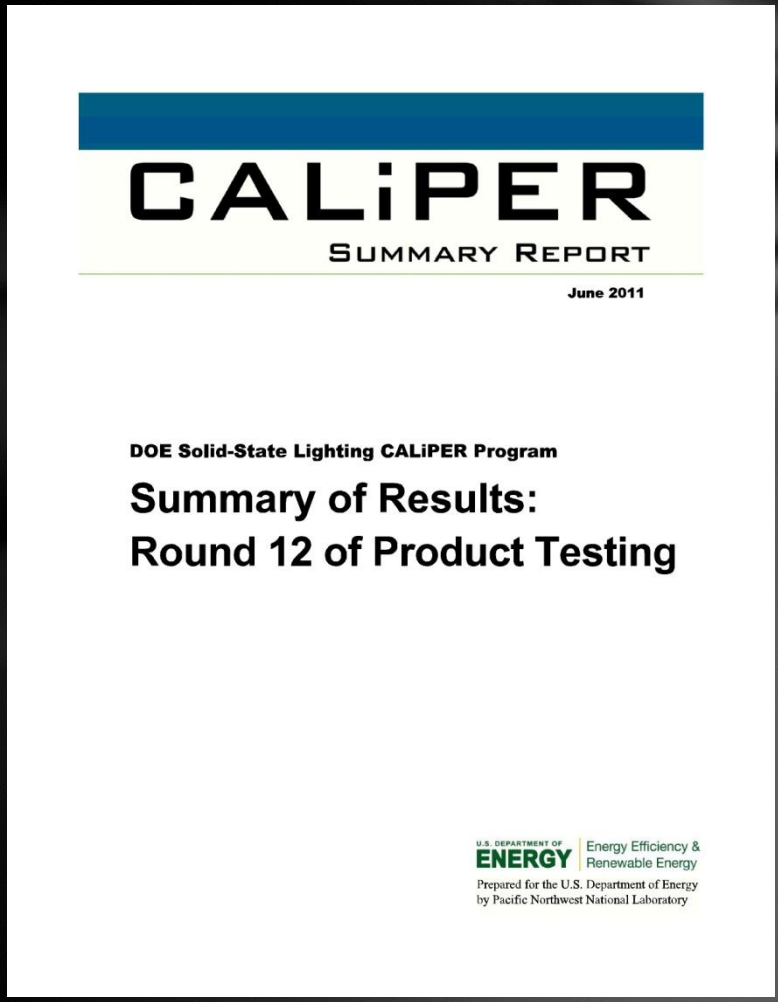
"Real" LED Products?

Search:

EERE Caliper

Or…

www.eere.energy.gov/buildings/ssl/caliper.html



DOE Compares products:

- Straight-up test results
- No recommendations
- Free for you to review
- Detailed product tests results

Table 1a. CALiPER ROUND 11 SUMMARY – Outdoor Roadway Luminaires

– SSL testing following IESNA LM-79-08 – 25°C ambient temperature	DOE CALiPER TEST ID	Total Power (Watts)	Output (Initial Lumens)	Efficacy (lm/W)	CCT (K) [D_{uv}]	CRI	Photo
SSL Arm-mount Roadway Luminaires/Replacement Lamps							
Outdoor Roadway (Bare lamp only, not installed in a luminaire)	09-62	38	970	26	3080 [0.006]	69	
Outdoor Roadway	09-113	79	2549	32	5058 [0.003]	70	
Outdoor Roadway	10-09	73	4994	68	5302 [0.004]	80	
Outdoor Roadway	10-10	72	4469	62	6262 *[0.011]*	70	
Outdoor Roadway	10-14	44	3994	90	4947 [0.007]	66	
Outdoor Roadway	10-26	150	7004	47	5127 *[0.019]*	66	
Benchmark (BK) Arm-mount Roadway Luminaires: High Pressure Sodium (HPS) and Induction from Earlier CALiPER Testing							
Outdoor Roadway High Pressure Sodium	*Round 7 BK 08-122*	117	6540	56	2042 [0.001]	21	
Outdoor Roadway Induction	*Round 7 BK 08-152*	67	3960	59	3906 [0.001]	75	
Outdoor Roadway Induction	*Round 7 BK 08-153*	71	3561	50	4253 [0.006]	77	
SSL Post-top Luminaires							
Outdoor Post-top	10-13	48	2701	56	4302 [0.003]	68	
Outdoor Post-top	10-27	25	854	35	6789 [0.006]	77	
Benchmark (BK) Post-top Luminaires: Ceramic Metal Halide (CMH) and Pulse Start Metal Halide (PSMH)							
Outdoor Post-top Ceramic Metal Halide	BK10-15	178	9104	51	3017 [-0.003]	85	
Outdoor Post-top, solid top PSMH	BK10-35	192	7812	41	3400 [0.005]	62	

Values are rounded to the nearest integer for readability. Results shown in this table are from testing at 120VAC.
Duv values which are not with ANSI-defined tolerances for white light in SSL products are shown in *red italics*.

DOE SSL CALiPER results may not be used for commercial purposes under any circumstances; see "No Commercial Use Policy" (http://www.ssl.energy.gov/comm_use.html) at http://www.ssl.energy.gov/caliper.html for more information.

DOE Lighting Facts Label:

Lighting Facts™

LED Product

Light Output (Lumens)	**840**
Watts	**9**
Lumens per Watt (Efficacy)	**93**
Color Accuracy Color Rendering Index (CRI)	**87**

Light Color Correlated Color Temperature (CCT) **3100 (Warm White)**

Warm White | Bright White | Daylight

2600K 3200K 4500K 6500K

Visit www.lighting-facts.com for the *Label Reference Guide*.

All results are according to IESNA LM-79-2008: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.

Brand X, 18756CHT5642895ARGHT1234H3

LED Pilot Program

Tomorrow's

Classroom,

Today!

Questions…

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Thank you!